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1950

THE PAN-PACIFIC ENTOMOLOGIST

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TAXONOMIC NOTES ON SOME SMALLER BOMBYLIIDAE

(Diptera)

BY A. L. MELANDER[1]

(Continued from last issue, p. 144)

Glabellula rotundipennis Melander, new species

Male. Length 1.3 mm. Depressed part of front dull brownish, face black; third antennal joint oval, one-fourth longer than deep, style short and thick, one-half longer than wide and one-fourth as long as third joint; proboscis slightly projecting. Humeri, narrow notopleural suture and posterior calli yellow; pleurae with an irregular inconspicuous yellow median line. Abdomen altogether black, opaque, its hairs black. Legs black, apex of femora slightly brownish. Wings lightly infuscated, veins blackish; halteres dull yellowish, the stalk brown.

Holotype: South Forks of Santa Ana River, San Bernardino Mountains, California, at elevation 6250 feet, June 18, 1945. A female from Camp Baldy, San Gabriel Mountains, California, July 1, 1945, has the hind margin of the seventh abdominal segment narrowly yellow.

Prorates Melander

Syn.: *Alloxytropus* Bezzi, Bull. Soc. Roy. Entom. Egypte, 1924: 186 (1925).

In Entomological News, 1906, p. 372, I erected the genus *Prorates* for a small species, *claripennis*, from New Mexico, placing it in the subfamily Hybotinae of the Empididae. Reviewing the genus in Genera Insectorum, fasc. 185: 376 (1927) I transferred it to the Bombyliidae within the subfamily Heterotropinae.

The Bombyliid genus *Alloxytropus* Bezzi, known from two Egyptian species, is the same as *Prorates*. Efflatoun has published lengthy and well illustrated descriptions of the palaearctic species (Bull. Soc. Fouad 1er Entom. 1945). His specimens were taken in the heat of early afternoon as they hovered slowly.

On May 3 and 4, 1945, I took a dozen specimens of *P. claripennis* inside my automobile while in camp at Palm Canyon in the Borrego Desert in Southern California. The flies were taken early in the morning on the windshield and windows as they endeavored to escape from the car, which they had entered for the night.

Apystomyia Melander, new genus

Eyes of male contiguous from ocelli almost to antennae, not notched, the facets of upper two-thirds coarse, lower facets abruptly minute; front of female very broad above; occiput quite flat; ocelli of male large, on the elevated vertical triangle; mouth opening broad and large, obliterating the face, the cheeks wide, eyes distantly separated below; antennae inserted low on head, basal joints minute, third joint rotund and compressed, microscopically pubescent, the apical style cylindrical, blunt, about one-third as long as the third joint; mouth parts vestigial, fleshy, not projecting. Thorax glistening jet black, with long coarse hairs, scutellar margin setose; pleurae bare. Abdomen slender, tapering, pilose in male, not tomentose, pygidium minute, globular, with two small erect spatulate dorsal palps enclosed by a pair of almost triangular lateral valves tipped with a few setulae, ventral piece small. Legs with coarse hairs, almost setose on femora and tibiae, without tomentum, pulvilli present. Wings very delicate, costa continuing to fourth vein, first vein chitinized, other veins of male thin and translucent, anal lobe very large, alulae moderate, third vein forked near tip of wing, fourth vein forked, the petiole of second posterior cell about as long as posterior crossvein, discal cell narrow, elongate, anterior crossvein at basal third, petiole of anal cell about as long as the arched anal crossvein; calypteres with nearly straight edge, heavily fringed.

Genotype: *A. elinguis* Melander, new species, following.

This enigmatical little fly does not seem to be related to any other genus, and its assignment to the Heterotropinae is made because it does not conform with any other subfamily or family. Superficially the neuration is of the same pattern as *Prorates*, that is, the same veins and cells are present, but the proportions and dimensions of vein sections are so wholly dissimilar that the resemblance can at best be only coincidental.

Because of the almost complete absence of the ambient vein the genus will key to the Scenopinidae in Curran's Manual, etc., but it will be recalled that also in *Prorates* as well as in *Caenotus canus* the costa stops near the tip of the wing. *Apystomyia* has

very delicate neuration, with the fourth vein forked and the anterior crossvein toward the base of the discal cell, an abundance of rather stiff pile, and a strong antennal style, all of which characters preclude inclusion in the Scenopinidae.

Apystomyia elinguis Melander, new species

Male. Length 3 mm. Black, head and thorax polished, abdomen and legs subopaque; hairs of head and thorax abundant, rather stiff and black, of abdomen finer and white. Sides of occiput with dense coarse pile directed laterally; ocellar triangle with four erect stiff hairs; the very small front with two projecting long hairs; hairs of the wide cheeks numerous and less stiff. Hairs of thorax well separated, but long, erect and rather stiff, denser above notopleural suture, scutellum with twelve long marginal hairs. Abdominal hairs long on basal half, becoming shorter caudally. Inferior hairs of front femora black, about three times diameter of the joint, hairs of posterior femora finer and white; front tibiae with an extensor row of eight hairs; middle tibiae gradually enlarging distally, with a subapical stout broad spur underneath, at base of which the tibia is strongly excised, with ten extensor hairs and underneath with a closer row of hairs which are small along the middle, the last one a stout seta; hind tibiae with a double row of extensor hairs, the anterior ones black, the posterior row white, no hairs beneath; last third of middle metatarsi strongly capitate; basal half of hind metatarsi and all of third and fourth joints white. Wings milky translucent, root black, costa and first, second and third veins mostly brownish though thin, other veins translucent whitish, third vein forked just before end of second vein, the branch only slightly arched and two-thirds as long as last section; alula with long white fringe, calypteres black anteriorly, white behind, the fringe long and white; halteres wholly full black.

Female. Occiput without the lateral bunches of hairs; hairs of thorax less abundant, six scutellar bristles; abdomen quite bare; hairs of legs inconspicuous, all black, middle legs normal, hind tarsi wholly black. Wings subhyaline, not milky, posterior veins more or less like anterior.

Holotype and allotype: WRIGHTWOOD, on the north slope of SAN GABRIEL MOUNTAINS, CALIFORNIA, May 24, 1945. The specimens were discovered in sweepings from vegetation along the small stream which later disappears in Sheep Creek Canyon. *Paratypes:* Five males, six females: with the types, and Sheep Creek Canyon, same day; Camp Angelus and Sugarloaf Mountain in the San Bernardino Mountains, May to July; and near Keene Camp on Mount San Jacinto, June 7, 1942. The specimens from Sugarloaf

Mountain were found along the overflow from a small spring at elevation about 7000 feet. The species seems to be subalpine and attracted to moisture.

Apystomyia, Greek, literally, a fly of which nothing is known; *elinguis,* Latin, without a tongue.

CAENOTUS Cole

The genus *Caenotus* was originally placed in the Therevidae, from which family it differs in the lack of bristles, the short antennae, and in having the second basal cell pointed distally, without being blunted by the characteristic "small crossvein." Cole described two closely related species, *inornatus* with four posterior veins and *minutus* with three veins from the discal cell. Both species were taken at Alamogordo, New Mexico, with *Prorates claripennis* at Highrolls, near by.

In the Genera Insectorum, fasc. 185: 376 (1927) I transferred *Caenotus* to the Bombyliidae, where it can be placed in the subfamily Heterotropinae. *Caenotus minutus* and the following new species key to the Bombyliidae in Curran's Manual, but *inornatus,* because of its five posterior cells, leads to the Therevidae.

KEY TO THE SPECIES OF CAENOTUS

1. Discal cell emitting four posterior veins; hind tibiae yellowish; male genitalia wholly luteous. (N. Mex.) ....*inornatus* Cole
– Discal cell emitting three posterior veins; legs blackish; male genitalia more or less blackened 2

2. Thorax of male openly pilose, notal hairs erect; pygidium posteriorly open below and with a pair of projecting caudal styles; facets of male eyes nearly uniform above antennae 3
– Thorax nearly bare, the sparse notal hairs short, reclining and white; pygidium closed, spherical, without projecting caudal processes; uppermost facets of male much smaller than those toward antennae. (Cal.) .....*canus* Melander

3. Pile of head and mesonotum white; wings slightly milky because of the white microtrichia, second submarginal cell evenly enclosing wing-tip; body opaque, lightly cinerous; eighth tergite of male not developed. (N. Mex.) .....*minutus* Cole
– Pile of head and mesonotum mostly black; wings clear hyaline, branch of third vein ending just before wing-tip; body black, the abdomen shining; eighth tergite of male subequal to seventh. (Ariz.) .....*hospes* Melander

Caenotus canus Melander, new species

Male. Length 3 mm. Black, head and upper side of body lightly coated with cinereous pollen, more densely on mesonotum. Upper occiput concave, the hind margin of the eyes forming a broad V, ocellar triangle not protuberant, facets near ocelli as small as those of the sunken lower area of the eye; chin with a few white hairs; mouth parts retracted; third joint of antennae conical, two and one-half times as long as wide, the apex scarcely constricted. Hairs of rear of notum and of scutellum sparse, short and erect; mesopleura with a few fine white hairs; sternopleura polished below. Hairs of abdomen scattered and inconspicuous; pygidium polished black, its hairs sparse and pale, eighth tergite not developed; venter glabrous, first four segments polished, remainder lightly cinereous. Legs black, hairs inconspicuous. Wings hyaline, broader than in the other species, veins brownish becoming paler towards base, sides of second submarginal cell nearly parallel, third vein (R_5) ending at wing-tip, costa continuing to third vein, no ambient vein, the three posterior veins not reaching margin, anal cell three times as long as wide, last section of anal vein two-thirds length of anal crossvein, anterior crossvein at middle of discal cell; halteres with large white knob, the stalk dusky.

Holotype: About five miles south of ADELANTO, CALIFORNIA, May 23, 1945.

Caenotus hospes Melander, new species

Male. Length 4-5.5 mm. Black, the pollen of head and thorax dark gray, scutellum and whole abdomen shining. Upper occiput not encroaching on eyes, ocellar triangle elevated, its black hairs proclinate, upper facets virtually uniform, the ventral area of small facets not sunken; chin and palpi black-pilose; basal joints of antennae with rosette of hairs; third joint with nearly round base and subequal thick styliform end. Notal pile rather dense, erect and black, but the hairs of humeri, mesopleura and sternopleura white, sternopleura not shining; front edge of mesonotum marked with a white pruinose spot on each side next to the humeri. Hairs of abdomen long and fine but shorter on ventral segments; pygidium distinctly longer than wide, the upper cover deflexed apically at the sides. Legs black, the femora with fine whitish hairs. Wings hyaline, veins light brown becoming yellowish at base, costa thinning at tip of wing but continuing as the ambient vein around hind margin, second submarginal cell widening apically, all veins reaching margin, anterior crossvein at middle of discal cell, anal cell four and one-half times as long as wide, last section of anal vein not half the length of the anal crossvein; halteres white, the stalk dusky at base.

Female. Pubescence much shorter, hairs of chin, palpi and sides of notum whitish, notal pubescence mostly reclinate; head and notum mostly brownish-pollinose; front two-thirds as wide at ocelli as at antennae, uniformly opaque. Wings lightly infumated, veins dark to base. The head is relatively smaller and the abdomen longer than in the male.

Types: ORGANPIPE CACTUS NATIONAL MONUMENT, southern ARIZONA, at Headquarters camp, 62 males and 6 females, taken during the latter part of April, 1947 and 1948. Nearly all the specimens were found on the outside of the windows of our house trailer during the day. A very few were attracted to light. One specimen has the second posterior cell separated from the pointed discal cell by a short petiole.

Heterotropus senex Melander, new species

Male. Length 4 mm. A short, stocky, black, opaque, heavily glaucous, white-pilose fly with massive pygidium, separated eyes and rather long antennae. Most of the insect is black, but the front except upper third, face and cheeks are yellow, three-fourths of the tibiae and apical parts of pygidium are reddish yellow, abdominal incisures are obscurely yellowish and the halteres are mostly whitish. Eyes separated more than the width of an ocellus, lower facets smaller than upper, front and face bare, cheeks and chin with long loose hairs, pile of upper occiput and ocellar triangle curved, face one-fifth as long as front; antennae as long as head, first antennal joint twice the size of the globular second joint and furnished with loose long hairs, third joint subulate, twice as long as basal pair, the thick apical style one-third as long as the third joint and appearing as a continuation of it, under high magnification the apex shorn off below and bearing a minute sensilla in the middle of the depression; proboscis strong, about head-height, obliquely porrect; palpi slender, apparently two-jointed. Hairs of mesonotum and scutellum erect and uniformly distributed, mesopleura with scattered hairs, pleurae otherwise bare. Abdomen clothed with similar hairs, shorter on venter; pygidium comprising a large dorsal hood beneath which are two strong claspers having their apex spoon-shaped, curved outward and chitinized, ventral piece heavily convex, its apex deeply emarginate. Legs with normal pubescence, becoming pilose under femora; middle tibiae with two small apical spurs. Wings hyaline, veins yellowish at base, becoming brown, first vein ending opposite posterior crossvein, third vein forked nearly midway between anterior crossvein and wing tip, the branches greatly diverging to include tip of wing, anterior crossvein slightly before middle of discal cell, anal cell closed at margin, ambient vein strong.

Holotype: ORGANPIPE CACTUS NATIONAL MONUMENT, ARIZONA,

at Headquarters, April 16, 1948, taken on flowers of desert marigold, *Baileya multiradiata.*

This is the first record of the occurrence of this palaearctic genus in America. Engel, 1937, listed twenty-six named species and varieties, and these show a sufficient range in color and structure to admit the American species to the genus without question.

HETEROTROPINAE

Heterotropus, Caenotus, Prorates and *Apystomyia* may be grouped together in the subfamily Heterotropinae. As such they are differentiated from the other Bombyliidae by having the occiput flattened, eyes of male bisected into two sizes of facets but not indented behind, tibiae without seriate spines, third vein forked, first posterior cell open and anal cell petiolate. To provide for these genera the following modifications may be made in Curran's key in his Manual, pp. 195, 197. *Oncodocera* and *Phthiria* are not related, but key into this group.

19. With four or five posterior cells 24
24. First posterior cell open 31
31. Two submarginal cells 36
36. Anal cell closed 37
37. Proboscis projecting beyond the anterior oral margin 39
— Proboscis short, not projecting beyond the anterior oral margin ..... b
39. The intercalary vein between the fourth and fifth veins arising from the discal cell ..... a
— The intercalary vein arises from the fourth vein, the second posterior cell petiolate; no ambient vein; third antennal joint conical, style microscopic ..... *Prorates* Melander
a. Third antennal joint subulate; costa continued around hind margin as the ambient vein ..... *Heterotropus* Loew
— Third antennal joint scarcely tapering, the apex excised or more or less truncate, with a microscopic sensory hair; proboscis long, labellae narrow; ambient vein stopping at anal vein ..... *Phthiria* Meigen
b. Abdomen much broader than the thorax and densely pilose; hind margin of eyes concave and indented, facets uniform in male ..... *Oncodocera* Macquart
— Abdomen elongate and not furry; eyes not indented behind, facets of two distinct sizes in male c
c. Third vein forked near discal cell, second posterior cell sessile, discal cell shorter than basal cells; thorax opaque pollinose— ..... *Caenotus* Cole
— Third vein forked near apex of wing, second posterior cell long-petiolate, discal cell longe rthan basal cells, thorax glistening jet black ..... *Apystomyia* Melander

CYLLENIINAE

Exepacmus nasalis Melander, new species

Female. Length 5 mm. Face strongly protuberant, conical, the head transversely impressed at antennae, face shining black, almost bare but with some white pruinosity in back, cheeks yellowish, receding, front black, mostly shining, orbits narrowly and anterior part continuing on facial orbits, white-pruinose, pile scattered, erect, wholly black, front three-fourths as wide at ocelli as at antennae, slightly convex; occiput deeply grooved behind ocelli, the sides swollen, pile short and whitish above, absent below; first antennal joint almost cubical, second joint very short, third joint about twice length of basal joints together, with short pyriform base smaller than first joint, and with thickened styliform process nearly twice as long and half as deep as base, the apical two-thirds of the end process slightly expanded and terminated by a weakly sutured square style bearing a minute seta. Thorax opaque black, with whitish tomentum and hairs, scutellum with eight yellow marginal bristles; pleurae whitish-pilose above, centrally with white tomentum. Abdomen opaque blackish, tomentum yellow above, white on venter, hairs sparse and yellow, a few black hairs dorsally at rear of segments, most abundant on seventh segment, eighth segment large, deflexed, rufous, distally with appressed golden fringe, genitalia tipped with rosette of yellow spines. Coxae and femora black, bearing white scales, knees briefly and tibiae yellowish, hind femora and all tibiae with strong seriate black spines, tarsi black, base of middle metatarsi yellowish, pulvilli as long as claws. Wings hyaline, veins firm, second vein arising from third at basal fourth of discal cell, forming an angle of about 70 degrees and then rounding off, anterior crossvein at middle of discal cell, third and fourth veins apically nearly parallel, apex of anal cell slightly narrower than that of first posterior cell; halteres yellow.

Holotype: SHEEP CREEK CANYON, four miles south of PHELAN, CALIFORNIA, April 25, 1946.

The species agrees well with Coquillett's description of the genus and *E. johnsoni*, the only other species, except that the genotype has the face, base of antennae and femora yellow. Apparently the face of the new species is more protuberant and the antennal depression is not mentioned by Coquillett.

Exepacmus has the knee-like origin of the second vein similar to that in *Exoprosopa*, but the second vein arises much before the anterior crossvein.

DESMATONEURA ARGENTIFRONS Williston

This genus and its single species was described in 1895 from a single male from Albuquerque, New Mexico. It measures 8

millimeters, has black legs with the knees alone yellowish, the wings broadly brownish across the middle with the distal part of the wing cinerous. I have received through Dr. H. Hagan two females collected August 1 and 2, 1918 at Lynndyl, Utah, by George E. King, that may be the dimorphic other sex of *argentifrons*. They differ in size, being 4 and 5 millimeters long, in having yellowish tibiae and nearly hyaline wings, uniformly but slightly infuscated, the costal cell fuscous almost to end. One specimen has the origin of the second vein about twice the length of the anterior crossvein from the latter, as in Curran's figure 80 in his North American Diptera, page 199, but the anal cell is two-thirds as wide as the first posterior cell on the margin. The other specimen is abnormal in having the anterior crossvein duplicated in the right wing, but in the left wing the knee of the second vein arises at a distance the length of the anterior crossvein from the latter, and the anal cell is almost closed, as in Curran's figure.

Female. Postocellar groove deep, front broad, widening below to slightly more than twice the distance between the eyes at the vertex, moderately white-pollinose, with short white proclinous pubescence, the front edge yellowish; antennae widely separated, the third joint with bulbous base and styliform process as in most species of *Aphoebantus;* face retreating. Tomentum and hairs of body whitish. Tip of abdomen and last ventral segments yellowish.

PARACOSMUS Osten Sacken

Loew described (Centuries X, 48) *Allocotus* n. gen. *edwardsii* from a female from California. Osten Sacken (Western Diptera, 262) noted that *Allocotus* was twice preoccupied and established the name *Paracosmus*. Later (Biol. Centr.-Am., Dipt. I, 155) Osten Sacken described a second species, *P. morrisoni*, from Sonora. From the descriptions it should be possible to separate the two. *P. edwardsii* has a distinct row of median triangles along the abdomen, black halteres, and the front of the female white-pollinose except above and below. In *morrisoni* the margins of the abdominal segments are uniformly whitish, the halteres more or less yellow, and the frontal orbits alone are pollinose. When trying to allocate the 44 specimens before me I would assign those from California to *edwardsii* and those from Arizona and New Mexico to *morrisoni*. This is in agreement with material determined by Coquillett and C. W. Johnson, but Cole identifies the Californian specimens as *morrisoni*.

There is much intergrading between *edwardsii* and *morrisoni*, so it is doubtful if two species exist. The size of the white triangles on the abdomen varies and especially in the females has a tendency to flatten out; the color of the halteres is not reliable; and the extent of the pollen on the front of the female is subject to much variation. Venation, pollinosity and color of the face are of no help. The characters selected for the following table show some correlation, but identification will depend on which side of the couplet holds most agreement with the specimen. *Paracosmus insolens* Coquillett is a distinctive species, and the new species, *rubicundus*, is quite unrelated to the others.

KEY TO THE SPECIES OF PARACOSMUS

1. Head and body almost wholly black; lower occiput polished; front of female largely polished, of male argenteous; antennae black; veins black; pygidial parts large, projecting caudally....2
– Head, body and legs almost wholly or largely yellow; first antennal joint yellow; veins mostly yellow; pygidial parts very small; front and occiput silky .....*rubicundus* Melander

2. Femora and tibiae reddish or brown; hairs in front of halteres loose; anterior crossvein distinctly beyond middle of discal cell; first antennal joint about twice as long as second; lateral valves of pygidium not lobate; size 5 - 10 mm. 3
– Legs black, only extreme base of tibiae yellowish; a dense cluster of silver-white pile in front of halteres, similar dense pile along notopleural suture and at sides of first abdominal segment; anterior crossvein near middle of discal cell; basal antennal joints subequal; lateral valves of pygidium ending in large incurved lobes; size 3.5 - 4.5 mm .....*insolens* Coquillett

3. Whitish abdominal fasciae expanding in the middle into a series of triangles decreasing in size posteriorly; front of female pruinose except anterior third and at vertex, twice as wide at antennae as at ocelli; halteres usually blackish; lateral valves of pygidium nearly as wide near apex as near base, all black, ventral piece rotund and not tapering; veins black to brown.....*edwardsii* Loew
– Whitish abdominal fasciae without definite triangular expansions in middle; front of female pruinose narrowly along orbits, scarcely twice as wide at antennae as at ocelli; halteres usually paler; lateral valves distinctly narrower apically, usually with yellowish border, ventral piece shaped somewhat like a scorpion's stinger; veins yellowish to brown .....*morrisoni* Osten Sacken

Paracosmus rubicundus Melander, new species

Male. Length 5.5 - 7.5 mm. Vertex blackish, about one-third as wide as lower front, center of occiput black in ground color, roof of oral cavity narrowly blackish, remainder of head flavous, mostly sericeous, cheeks shining; second joint of antennae blackish, third joint wholly black, elongate elliptical, four times as long as wide, widest at middle, the apex obliquely truncate, longer below, with a microscopic sensilla at upper angle; proboscis one-half longer than head, black except basal sheath, palpi very slender, U-shaped, the enlarged tip black. Disk of thorax black, with close appressed pubescence, sides largely flavous, hairy in front of wings; scutellum with small blackish median spot at base; pleurae marked with blackish on lower mesopleura and near legs, mesopleura and hypopleura hairy, anterior pteropleura shining; all vestiture whitish. Abdomen robust, first segment and hind margins of others flavous, remainder reddish, the sides of segments three and four each with an oval black spot; genitalia not projecting, the sides of the ninth segment infolded as short flaps, ventral piece rotund but small. Tarsi apically brown, anterior pairs with minute pulvilli, no pulvilli on hind tarsi. Wings hyaline, anterior crossvein at two-thirds discal cell, third vein without spur, first posterior cell at margin three times as wide as end of anal cell; halteres ivory white.

Female. Vertex half as wide as lower front; genitalia forming a round truncated end to the abdomen, the sides with long golden fimbria.

Types: SONORA, MEXICO, 83 kilometers south of the Border, on the road to Rocky Point, April 21, 1947. The flies were found in considerable numbers on the sand dunes from which they were reluctant to fly. Finally, they were caught by laying the net flat on them and removing them with the fingers, often a painful operation for the dunes were filled with long-spined barbed sandburs, usually just hidden under the sand. Professor Timberlake and I found the species also near Palm Springs, California, on May 6, 1946. There are 22 paratypes.

This species differs strikingly from the black species in color, sericeous not shining coating, reduced pulvilli, small pygidial parts, and elongate third joint of the antennae. The black females have the end of the abdomen compressed.

KEY TO THE SPECIES OF METACOSMUS

1. Face, cheeks and chin mostly pale yellow; legs largely yellowish; anal cell narrowed apically though wide open; abdomen bare 2

– Face, cheeks and chin mostly black; legs black, anal cell not tapering apically; abdomen pubescent. (Cal.) .....*nitidus* Cole

2. Legs yellowish brown; anterior crossvein at last third of discal cell; stem of halteres brown. (Cal., Ariz.) .....*exilis* Coquillett

– Legs partly black, the extreme base of hind femora, apical part of anterior tibiae and base of tarsi yellow; anterior crossvein at three-fifths the discal cell; stems of halteres white. (Penn.) .....*mancipennis* Coquillett

Curran has figured the wing and head of *mancipennis* in his Manual of the Genera of American Diptera. F. X. Williams has collected *exilis* in the Huachuca Mountains, Arizona (Citrus Experiment Station collection). Timberlake has *nitidus* from Santa Rosa Mountains, California, at 7500 ft. altitude, and I have taken the same species at the South Forks of the Santa Ana River, in the San Bernardino Mountains, at 6300 feet.

NOTES ON CERTAIN MEXICAN COCCINELLIDAE

(Coleoptera)

BY BORYS MALKIN

University of Washington, Seattle

During the summer of 1947 the writer spent three months collecting insects in various parts of Mexico, mainly in the states of Nayarit and Oaxaca. In the coleopterous family *Coccinellidae* about forty species were accumulated. Of these, five seem to be new records for Mexico and were not listed in the Blackwelder catalogue[1] of the Latin American beetles. The following species of *Scymnus* the writer regards as new.

[1]Blackwelder, R. E. 1945. *Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America.* Part 3. U. S. Nat. Mus., Bul. 185.

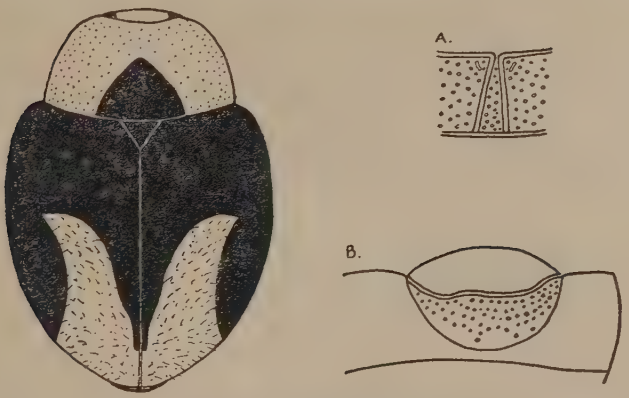

Fig. 1. *Scymnus mexicanus* Malkin, new species. A. Prosternal carinae. B. Abdominal plate.

Scymnus mexicanus Malkin, new species

Head: Dark, yellow-brownish, strongly punctured. Clypeus yellow. Palpi conical, yellow. *Pronotum:* very regularly curved, slightly more than twice as wide as long. Distinctly but not very strongly punctured and with dense golden pubescence. Color of thorax yellow with the usual black spot in the center reaching the base of the elytra. *Elytra:* very slightly longer than wide. Shining black except for the posterior portion where there is a brown-red spot on each elytron. These spots are prolonged into a spur and reach the middle of the disc, and coalesce only at the apex of elytra. Punctures on the elytra distinct and denser toward the sides. Yellow pubescence present throughout. Epipleura black except at the extreme apex where they are brown. *Prosternum:* yellow, darkened in the middle. Coarsely and closely punctured. Prosternal carinae converging in front, very distinct and uninterrupted. *Metasternum:* smooth, shining glabrous in the middle and sparsely pubescent toward the sides, with a feeble median impression. Punctures present on the sides, sparse. *Abdomen:* black, indistinctly punctured. Abdominal plates regularly curved not reaching the basal line of the first segment. *Legs:* dark yellow, femora darker in the middle. Length 2.1 mm., width 1.5 mm.

Type, of undetermined sex, in the American Museum of Natural History, New York. The specimen was collected by the writer at SALINA CRUZ, OAXACA, MEXICO, July 9-17, 1947, while sweeping miscellaneous vegetation. Salina Cruz is a port on the Pacific coast in the Isthmus of Tehuantepec region. It is an arid area approaching the conditions of the Sonoran Desert.

This species does not seem to be related very closely to any of the known Mexican forms of *Scymus* but comes quite close to *S. postpinctus* Csy., described from Wyoming[2]. From this it differs in somewhat smaller size, rounder form, sparser punctulation of the dorsal surface, entirely dark sides of the elytra, a well defined prosternal carinae, and larger and better defined elytral spots.

The additions to Blackwelder's catalogue are as follows:

Hyperaspis rotunda Csy.—Tequixistlan, Oaxaca, July 18 (1 specimen). Described from Texas and Louisiana.

Brachyacantha bolli Cr.—Monte Alban, Oaxaca, Sept. 14 (1 specimen). Former distribution as above.

Brachyacantha bistripustulata decora Csy.—Oaxaca, Oaxaca, July 20-24 (1 specimen). Described from Texas.

Brachyacantha bistripustulata guttata Weise—Oaxaca, Oaxaca, July 20-24 (6 specimens). This variety was taken with a very large number of *B. bistripustulata* (Fab.). The latter was also collected at Tepic, Nayarit, and Tolosa, Oaxaca (Atlantic slope of the Isthmus of Tehuantepec, in tropical rain forest), while I have seen specimens taken by Mr. B. E. White at Brownsville and Uvalde, Texas. Mr. White has also taken the variety *guttata* at Omos Park, Texas (all of his records in July, 1941) which incidentally would represent a new record for *guttata* in the United States. Blackwelder lists this variety only from Colombia, S. A. As all these records cover a very wide and diverse topographical province the exact status of the variety *guttata* is uncertain.

Brachyacantha tau Lec.—Oaxaca, Oaxaca, July 20-24 (several specimens), September 13-20 (3 specimens). Previous records are from Nebraska and Montana.

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[2]Casey, T. L. 1899. *A revision of the American Coccinellidae.* Jour. New York Ent. Soc. 7(2): 71-169.

A NEW NAME FOR A CALIFORNIA MOSQUITO

(Diptera, Culcidae)

BY B. BROOKMAN[1] AND W. C. REEVES

The George Williams Hooper Foundation for Medical Research, University of California, Medical Center, San Francisco

P. Galindo, in an unpublished thesis (Contribution to our knowledge of the genus *Culex* in California, Master of Science Thesis, Division of Entomology and Parasitology, University of California, Berkeley, 1943, pp. 49-55) proposed the name *Culex* (*Neoculex*) *reevesi* for a hitherto unknown species of mosquito from the coastal region of California. Wirth included *C. reevesi* Galindo in keys to the Culicidae of California (*in* Usinger, R. L., La Rivers, I., Chandler, H. P., and Wirth, W. W., Biology of Aquatic and Littoral Insects, University of California Syllabus Series, Syllabus SS. University of California Press, Berkeley, March, 1948, p. 230 and 231) in the mistaken assumption that the name had been published. Apparently Wirth based his diagnosis of the species on Galindo's unpublished description. However, since these keys were validly published in a form which complies with recent opinions of the International Commission of Zoological Nomenclature, meeting in Paris in 1948 (Usinger, personal communication), the name *C. reevesi* Wirth must hold under the rules of priority as being the first published for that particular species.

R. M. Bohart (The subgenus Neoculex in America north of Mexico, Ann. Entomol. Soc. Am., 41(3): 342, Sept., 1948) described what he believed to be the same species as that of Galindo, and, in deference to Mr. Galindo, retained the name, *C. reevesi*. However, we have found this species to differ from *C. reevesi* Wirth both in adult and in larval characters and consider it another species. Therefore, *C. reevesi* Bohart becomes a primary homonym of *C. reevesi* Wirth.

In order to clarify this situation, the present authors wish to designate *Culex boharti* Brookman and Reeves, n.n. for *C. reevesi* Bohart, September, 1948 (not *C. reevesi* Wirth, March, 1948).

[1]Sanitarian (R), Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.

A complete description of *C. reevesi* Wirth will be published by us in a forthcoming paper, "New records of mosquitoes from Lower California, Mexico, with descriptions of *Culex* (*Neoculex*) *reevesi* Wirth and the immature stages of *Culex* (*Melanoconion*) *anips* Dyar."

BOOK NOTICE

The Nature of Natural History. By Marston Bates. Charles Scribner's Sons, New York. [10+] 309 p. 1950. Price $3.50.

This is a book written to popularize science, to reveal its methods and motives, its techniques and philosophy, as applied to natural history. It succeeds admirably, helped by Dr. Bates' clarity and humor, and by being written in the first person. Yet it is equally a book for scientists, and especially for entomologists. The thought-provoking ideas and broad viewpoint, the simplification and summarization necessary for his purpose, are helpful to the student who has read voluminously but become lost in the details and failed to emerge with basic principles.

The first half of the book is expository, and moves a little slowly for the naturalist, but is essential for a wide audience. The rest is more philosophical. The author has spent years in the neotropics—indeed most of the manuscript was written at Villavicencio, Colombia—and has been impressed less by the idea of nature red in tooth and claw, than by the cooperation between organisms and within populations. This thought is being expressed widely these days, as in Ashley Montagu's "On Being Human." Whole paragraphs from Bates' book would not sound at all out of place in Overstreet's "The Mature Mind."

In his own words, the first three-quarters of the book discusses "the naming and cataloguing of organisms; their reproduction and development; their relations with the environment and their organization into populations and communities; and finally, their evolution, the explanation of the diversity of organic form and of its fitness or adaptation." For the last he apologizes as follows: "The project is, furthermore, dangerous, because all of my colleagues will read this book (not for information, but to find what mistakes I have made—I do the same thing with their books) and none will agree with the emphasis or the point of view, and they will be volubly dismayed at the topics I have neglected. I am caught, though, because it would be unthinkable to write a book on natural history without a chapter on evolution."

The last three chapters treat on the application of science, its relation to human economy; scientists themselves, personal quirks and all; and the nature of the scientific method. There are 7 pages of annotated selected references, and a full index in 11 pages.

—HUGH B. LEECH.

TWENTY-FIVE YEARS OF MIGRATION OF THE PAINTED LADY BUTTERFLY, VANESSA CARDUI, IN SOUTHERN CALIFORNIA[1]

CHARLES H. ABBOTT
University of Redlands, Redlands, California

The British naturalist, C. B. Williams, has for some years been collecting information from correspondents all over the world relating to migratory species of butterflies. In addition, he has made numerous observations of his own in various parts of the world (Williams, 1930; Williams et al, 1942). Yet little seems to have been done to concentrate on a single migratory species in a single region. The studies of Woodbury, Sugden, and Gillette in Utah (Woodbury et al, 1942; Sugden, et al, 1947) and of Beall in Ontario, Canada (1941) are important exceptions.

The author, who is not an entomologist, but who is interested in migration problems from the standpoint of animal ecology, first came in contact with the migration of the painted lady butterfly, *Vanessa* (*Pyrameis*) *cardui*, in the spring of 1924, in what appears to have been the greatest migration of the species since 1901. As a newcomer in southern California, he did not realize that such a migration was an exceptional phenomenon, in spite of the numerous questions which were asked him about it. It was not until the spring of 1925, when during the entire spring he saw only two painted ladies, and when he found that the literature was almost entirely lacking in reports of the 1924 migration, that he realized that here was an ecological problem of a spectacular nature which was being almost entirely neglected. As Redlands is popularly supposed to be strategically located on the migratory routes of birds, it promised to be a favorable location for analyzing butterfly migration.

Since that time there have been three migration years, 1926, 1941, and 1945, none of them involving as large numbers as 1924, but all conspicuous and lasting for several weeks. The plan of analysis has been to organize observers in all parts of southern California for making simultaneous observations and reports. The fact of one interval of fifteen years between migrations shows the difficulty of much organizing in advance (Abbott, 1941, 1946).

[1]A paper presented at a Symposium of the Zoology Division of the Seventh Pacific Science Congress of the Pacific Science Association, New Zealand, February, 1949.

This plan of study has involved in general two parts: detailed records at the University of Redlands with the assistance of students in zoology classes; and reports from other regions in southern California. In 1926 and 1941, I wrote to individuals whom I knew, mostly former students, in locations from which I desired information. In 1945, through lack of time to make contacts by correspondence, I advertised the matter in the press, and this proved to be the most fruitful in results. Of the many volunteer contributors, I wish to mention in particular Mr. Roy Cain of San Bernardino, who, with an occupation making him travel to all parts of San Bernardino County, kept detailed daily records for the entire period of the migration, approaching two months.

The study is a long way from solving any fundamental problems of insect migration. But it has established a few facts which are at least the basis for further work.

In the following summary, migration is used for any mass movement of animals from one locality to another, without assuming any theory as to its cause. Butterflies refers to the species *Vanessa cardui* unless otherwise specified.

Duration in Time

A migration extends over a considerable period of time, approaching two months. The 1924 and 1926 migrations were from early February to late March; the 1941 and 1945 migrations were from early March to late April. Most of the printed accounts, such as those of California observers summarized by Williams, deal only with a few days at the height of the migration.

The beginning of a migration can be noted by observing that the butterflies are all flying in the same direction, each one in a straight line. When ten butterflies are seen crossing a city street at the same angle in a distance of half a mile, it is time to open a notebook.

Each year's migration consists of a series of waves, the numbers increasing more or less daily to a maximum, then diminishing and increasing again. In 1926 and 1941 there were thus three peaks of maximum abundance at scattered intervals. In 1945 there were apparently three peaks within two weeks, so close together as to make separation somewhat uncertain. The relation of the waves to weather conditions is discussed later in this paper.

GEOGRAPHICAL EXTENT

The geographical extent should be considered in relation to the map of southern California (figure 1). It appeared to vary slightly in the different years, yet this variation may have been due to incompleteness of reports from certain regions. The 1941 records show best the complete path of migration from Campo on

Figure 1. Map of Southern California, showing the principal localities referred to. Migrants were reported from all these points in 1945, except those marked 1941. Cajon Pass is the principal pass through the mountain ranges to the Mohave Desert on the north. South of it is the interior valley and coast region of Southern California. Between Borego and the Colorado River is the Colorado Desert. (Drawn by D. L. Soltau.)

the Mexican border north to the southern slope of the San Bernardino Mountains in the vicinity of Cajon Pass. There they appeared to be crossing the east-west range without taking advantage of the pass. Intermittent observations north of the mountains followed them to Calico in the Mohave Desert, a distance of 170 miles from Campo.

The country covered south of the mountains was the type of California semi-desert known as brush or chaparral. North of the mountains it was true desert of the high altitude Mohave Desert type.

The eastern border of the migration extended well into the Colorado Desert, which is lower in altitude and hotter than the Mohave and in general a barrier to distribution as the Colorado River is approached. Incomplete records on the western border indicated that the butterflies did not quite reach the ocean beaches that year.

The 1945 records are valuable as showing a cross section of simultaneous migration from Hermosa Beach to Needles on the Colorado River, a distance of 225 miles. Over most of this front the butterflies crossed the mountains from the southern valleys and spread north over the Mohave Desert, reaching a point 225 miles north northwest of Campo. Reports indicated approximately the same peak days over the entire cross section.

As there was no opportunity for records from south of the Mexican border, the point of origin of the flights could not be determined. But in California they covered an area at least 225 by 225 miles. No reports were received of their crossing the mountains further west to Bakersfield in the San Joaquin Valley or to Santa Barbara on the coast.

The figures just given for the extent of the migration do not indicate that butterflies were evenly distributed over the territory at any one time. Counts showed axes of migrating paths, the numbers diminishing toward the boundaries. For example a wave of migration from March 14 to 21, 1941, had its axis in Redlands, with its boundaries approximately eight miles west and eight miles east of Redlands. By March 22 and 23 the axis had shifted a few miles west. W. S. Wright wrote of passing through three migrating paths in 1926 during a sixty mile ride inland from San Diego in an easterly direction, the butterflies being absent in the intervening regions.

DIRECTION OF MIGRATION

The direction of migration throughout the territory was usually north-northwest, varying to northwest or north. This in general was directly against the prevailing wind. Yet there were enough exceptions to suggest that butterflies can fly as efficiently at right angles to the wind as directly against it. It may be noted that Woodbury, Sugden, and Gillette (1942), in studying the 1941 migration in Utah and adjacent states, found the direction of flight varying from north to northeast. The territory studied by them is separated from that included in the present paper by a hot dry desert which is an effective barrier to many moisture-requiring species.

The possibility that flights against the wind may be flight toward more favorable moisture conditions is taken up later.

TOPOGRAPHY AND DIRECTION OF FLIGHT

The course and direction of the flight were not determined by natural topographic features. Cajon Pass, San Gorgonio Pass, and the branch of the latter known as San Timoteo Canyon are popularly thought of as migration routes. Yet the butterflies flew in straight lines, crossing these canyons and their branch canyons at any angle, or sometimes missing them entirely.

To maintain their straight path of migration, butterflies regularly rose over obstacles such as hedges and trees, even tall eucalyptus trees and three story buildings, yet they consistently kept within a few feet of the ground otherwise. Each individual butterfly appeared to be maintaining an even distance above the ground. A striking illustration could be seen from the roof of the Hall of Science at the University of Redlands where one looked down on the migrants and observed that when they flew over trees they flew no higher than necessary. When they reached the vertical south wall of the Hall of Science, most of them stopped to feed on a lantana bush, and on leaving flew around the west end of the building before resuming the north-northwest direction. A few, however, ascended in a spiral and passed over the roof.

It was also interesting to watch them cross a narrow canyon with steep walls. They consistently flew down one wall and flew up the opposite wall rather than crossing from rim to rim, which to the observer would have seemed the simpler method of following a straight line.

RATE OF FLIGHT

Each butterfly appeared to be flying at a steady even rate, although there were obvious individual differences. Measurements were made of the rate of flight by recording with a stopwatch the time required to pass over a measured distance of ground, the measurements being taken on days when the wind was very slight. The 1941 measurements showed times of between 5 and 10 seconds in flying 100 feet. The average, 7.5+ seconds, gives approximately 6.6 minutes for one mile and 9.1 miles per hour. A similar set of figures, made on the same field in 1945, averaged 7 seconds for 100 feet, 6.16 minutes for one mile, and 9.7 miles per hour.

TIME OF DAY AND WEATHER CONDITIONS

During a migration the largest flights occurred in warm, sunny weather, with a flight ceasing almost entirely if several cold, rainy days came together. This subject needs further investigation as a factor in the varying curve of abundance during the entire migration period.

The best statistical record of the hours of daily flight was kept at Redlands by M. Salmond, March 20 to 27, 1941. On all of these days the flight began between 8:15 and 9:00 a.m., and ended between 3:20 and 5:15 p.m. This was during a period when there was fog from late afternoon to early morning.

The actual beginning of a daily flight was described by Miss Salmond on April 25, 1941, when, at 6:50 a.m. six butterflies, which apparently had been "sleeping" on the lawn, flew up, circled around more or less, and flew off to the northwest.

FEEDING

Butterflies stopped freely to feed. Favored food plants were lantana, apricot, greasewood (*Adenostoma fasciculatum*), pussy-willow, various flowers of park and campus.

OTHER SPECIES

Were other species associated with *Vanessa cardui* in the migration? It is difficult to give an absolute answer, because the common species *Vanessa caryae*, usually considered non-migratory, remembles *cardui* so closely that they look alike when flying. However, it is easy to identify the two species when they are feeding on a lantana bush. The author did this many times, and,

while both species fed together, only individuals of *V. cardui* were seen to arrive from the southeast and leave in a northwest direction. The *V. caryae* left in any direction, usually flying to other plants.

Occasionally single individuals of *Vanessa atalanta*, easily distinguished, were seen in a migratory swarm of *V. cardui*, and these also fed commonly on the same food plants. It was noted, however, that the individuals of *V. atalanta* stayed longer on a food plant, and not once was one seen to fly away from it in a definite direction. Therefore the present conclusion limits the migration to the one species.

DISCUSSION

The migration of *V. cardui* is spectacular, always in the same direction with minor variations, at very irregular intervals, and through country where the climatic and vegetation types change very slightly. There is no present evidence that any of the migrants return, and they do not increase the permanent population of the territory over which they pass.

The two questions which most commonly occur are:

(1) Why do they migrate?

(2) What determines the direction of migration?

The most commonly proposed theory for the cause of this type of migration is the "pressure of population theory." This has been applied to migrations of insects, mammals, and even the rhythmic migration of birds.

Chapman, in his paper "Insect population problems in relation to insect outbreak" (1939), shows in detail how this theory holds true for insects under the most complex combinations of conditions. He includes migration as one of the manifestations of an insect outbreak.

To quote the part directly applicable to *V. cardui:*

"In cases represented by insects having a high biotic potential, the relaxation of environmental resistance during a single generation, or even for a very short time during a critical part of the reproductive period, may result in a population increase of outbreak proportions. On the other hand, in case of a low biotic potential or a slight relaxation of environmental resistance, it may be necessary to have several successive periods of reduced resistance occur to make it possible for a population to build itself to outbreak proportions."

Without knowing how Chapman would characterize the biotic potential of *V. cardui*, the paragraph just quoted gives enough variables to account for the irregular intervals between migrations and for the variation in numbers in the different years. Chapman further states:

"In the case of migrating insects, it is necessary to study the area from which they migrate to determine whether conditions are such that populations will be built up and that the breeding conditions will encourage the populations to migrate."

Because it is not known how far south of the Mexican border the flights originate, it is uncertain whether it is chiefly in desert or semi-desert conditions. But it is known that on the edge of the Colorado Desert in California, during the wildflower season, the corresponding period of maximum insect abundance is in March and April. The variable is the amount of winter rainfall and to some extent its monthly distribution, which has a direct effect on the abundance of wildflowers. A favorable year might greatly increase the butterfly population in the succeeding year. This is a point on which the data are not available.

A report of a concentration of a butterfly population in this region was given to the author by W. S. Wright of the Natural History Museum, San Diego, under the date of April 16, 1926. To quote:

"Early this spring one of our collectors visited the desert near Yuma, Arizona, and on his return reported millions of painted ladies on the desert, feeding on the Desert Encelia. Later a visitor to the museum corroborated this report, adding that the numbers were equally great in the region about Salton Sea and as far west as the entrance to Carriso Gorge on the S. D. and A. R. R. Just prior to the first flight observed in the city, there occurred a strong wind blowing off the desert. Now my theory is that the insects breed on the desert or in contiguous territory and that the strong drying winds cause them to seek other fields. Some instinct, or the force of the wind, drives them westward until they reach the cool ocean breeze, having the effect of turning them from the westward course towards the northeast in this locality."

Is there a possible truth in these sentences that this butterfly is precisely adjusted to an optimum condition of humidity, or of humidity and temperature combined? Does the prevailing north-northwest direction of flight, which exists everywhere except per-

haps in the extreme south region described by Wright, represent a direction which maintains this optimum?

If this theory should be correct, it does not explain why they continue on into the Mohave Desert, where the air becomes dry again. It may be that the flight gradually slows down in the Mohave Desert on that account. But it does show the need for experiments on the reaction of this species to moisture and temperature gradients.

Temperature is suggested, because the interior valleys of California and the coastal regions have fewer extremes thən the desert. Also the experiments of Kendeigh (1934) on birds indicate that temperature is more important than length of day in determining the fact and direction of bird migration. This is important in the west-east bird migrations in California in which temperature differences are conspicuous and the length of day factor is eliminated.

ADDITIONAL POINTS IN NEED OF STUDY

(1) Do these butterflies lay eggs along the migratory route and do they continue migration after egg-laying? References to egg-laying on migration are made by Woodbury et al (1942) and brief references by Campbell (1924) and Dow (1924); but little evidence is available on this point.

(2) Does a second generation move northward in late summer? Woodbury et al (1924) report one instance in 1935; and W. Hovanitz wrote me on September 18, 1944, that he remembered a single instance in Pasadena, California, in the fall of 1940, but that he had no notes on it. It may be noted that the California tortoise-shell, *Nymphalis californica* Bdv., aggregates and migrates irregularly in the late summer in northern California, but the direction of migration varies from north, through west and south, to southeast (Comstock, 1927; Williams, 1930).

(3) There are no reports of a fall migration of *V. cardui* in California. In 1941, I wrote to all observers who had reported on the spring migration asking them to report on any possible instance of a fall migration. All replies received were in the negative.

(4) A study of the distribution and abundance of *V. cardui* in southern California in a non-migratory year is very desirable, as well as of its behavior reactions.

SUMMARY

(1) The painted lady butterfly, *Vanessa cardui*, has had four migrations in southern California in twenty-five years, in the springs of 1924, 1926, 1941, and 1945.

(2) Against the background of the great migration of 1924, the lesser succeeding migrations have been analyzed qualitatively and to some extent quantitatively.

(3) Time relations. Each migration period lasted nearly two months, showing a succession of increases and decreases with three maxima. The maxima, which were irregularly distributed, appeared to be related to weather conditions. Flying occurred during the sunny hours of the day, and almost ceased during cold, rainy periods.

(4) Geographical extent. This was partially determined by compiling the reports of cooperating observers scattered over southern California. The territory covered in 1941 and 1945, carefully mapped, showed a northward flight from the Mexican border to the leading towns and highways of the Mohave Desert, a distance of 225 miles. This actually is too small a figure, because the flight, or part of it, originated south of the Mexican border, and it may have gone farther north into the less accessible parts of the desert.

(5) Geographical extent, continued. A west-east cross section in 1945 showed butterflies migrating simultaneously in all of the territory from the coast to Needles on the Colorado River, a distance of 225 miles. Farther south, the cross section is narrower, being limited on the east by the driest section of the Colorado Desert. Farther east, in Arizona and Utah, another set of butterflies was in migration, but averaging a month later, in both 1941, and to a lesser degree in 1945 (Woodbury et al, 1942; Sugden et al, 1947).

(6) Most of the territory in which the migration was studied is the California type of semi-desert known as brush or chaparral, although the flights actually extended many miles into the Mohave Desert.

(7) The butterflies fly in a straight line, usually north-northwest, regardless of topography, keeping a few feet above the ground, and rising over obstacles. The flight is usually against the wind, but is just as controlled when the wind comes from a different direction.

(8) The type of migration, large numbers at irregular intervals, is typical of the migrations of those insects and mammals which make a non-returning migration in a predictable direction at irregular intervals. Chapman's application of the "pressure of population" theory is shown to apply to this migration, and is given as the only current hypothesis.

(9) It is suggested, as a hypothesis for further analysis, that, while the direction of wind may not be the factor determining the direction of flight, the effect of the wind on either temperature or humidity may be a controlling factor. If so, the butterflies must be capable of very precise adjustment to these factors.

ACKNOWLEDGMENTS

Thanks are due to the many observers, here unnamed, who contributed much of the data on which this study is based; also to D. L. Soltau for the map in Figure 1.

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BOOK REVIEW

The Insect World of J. Henri Fabre. By Edwin Way Teale. Dodd, Mead & Company, N. Y., xvi + 333. 1949. Price $3.50.

Fabre's careful observations and masterful reporting of natural phenomena are too well known to require examination here. The studies which this great French naturalist gave to the world have already been translated into many other languages from the original French. Teale has concerned himself with the English translations of A. T. de Mattos which have long been a source of enjoyment to both naturalists and laymen. By a process of careful editing he has presented 40 interesting excerpts from 13 of the de Mattos books.

These selections are in the identical phraseology of the de Mattos translations but are seldom complete. In order to give a maximum coverage, Teale has done a skillful piece of editing which is worthy of some explanation. For example, Teale will give one paragraph from de Mattos, skip several pages, then present several complete pages without any apparent lack of continuity. In this manner many of Fabre's statements expressing his anti-selectionist views or comments concerning the wonders of divine creation have been deleted. For the younger naturalist these omissions will serve to emphasize the natural wonders of Fabre's world. However, as Teale has indicated in his introduction, an understanding of Fabre's belief in the immutability of creation is necessary for a full appreciation of his abilities and limitations. For the benefit of the reader, Teale has given a brief foreword to each chapter along with the source of each selection. However, chapter ten is credited to the Mason Bees while it should have been referred to chapter six of Bramble-Bees and Others.

Unfortunately Teale did not see fit to illustrate this book, other than with a series of end plate photographs. One of these illustrations is misnamed as a Meloe oil-beetle while it appears to be a member of the genus *Epicauta*.

Minor criticisms as these are no indictment of the excellence of Teale's work in bringing together so many carefully selected and well edited passages from Fabre's life work. This is particularly so since so many of Fabre's observations were the first of their kind and in many cases have not yet been duplicated.—J. W. MACSWAIN.

NOTES ON THE CLASSIFICATION OF TORYMUS WITH THE BIOLOGY AND DESCRIPTION OF A NEW SPECIES

(Hymenoptera: Torymidae)

BY KENNETH R. HOBBS

Oregon State College, Corvallis[2]

Torymus festivus Hobbs, new species

Female: Length 2.5 mm.; ovipositor 2.2 mm. Body blue-green with purple reflections on propodeum and dorsal surface of abdomen. *Head* transverse, wider than thorax, slightly wider than long as viewed from the front; front green with lateral area beyond clypeal region blue with yellow reflections near eye margins; face below antennae with long, delicate hairs becoming short above; two fine carinae extending upward from margin of mouth curving slightly mesad and about as long as the basal distance between them; a prominent median carina; antennal depressions deep, bright shiny blue; scape somewhat compressed, not reaching median ocellus, yellow beneath and fuscous above, pedicel and ring segment infuscate; funicle and club brown with light brown longitudinal sense organs extending almost the entire length of each segment and beyond apical margin of each funicular segment; all segments of funicle sub-quadrate increasing in width toward the tip; ocelli brownish-red; eyes red.

Thoracic dorsum blue-green, minutely punctured, moderately clothed with short whitish hairs anteriorly to very long whitish hairs posteriorly on scutellum; parapsidal furrows distinct; scutellar crossfurrow absent; propodeum weakly reticulate, shining bluish-purple anteriorly to purple posteriorly, green laterally; fore coxa blue-green with apex yellow, middle and hind coxa green; basal and apical portions of femur and tibia honey yellow, median portion brown with metallic green reflections from hind femur; front tibial spur bifid as seen under high power; first three segments of tarsi approaching white, the last two dark brown; wings moderately ciliate; veins testaceous, a small crescent-shaped vein remnant one-fourth the distance from the base of wing in middle; stigmal vein petioled.

Abdomen longer than thorax; dorsal surfaces blue-green, finely reticulate, sparsely clothed with silky white hairs, fourth segment blue, moderately reticulate with long white hairs laterad; segments

[1]This publication is a portion of the thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts from the graduate school of Oregon State College.

[2]Instructor, California State Polytechnic College, Voorhis Unit, San Dimas, California.

five and six bluish-green with yellow reflections, reticulations and hairs same as for segment four; the sterna infuscate; pygostyle with one heavy and three fine setae of approximately equal length.

Male: Length 1.95 mm. Scape short, light brown basally, the remainder being dark blue-green with purple reflections; abdomen dark brown with bluish reflections dorso-basally, the remainder, dorsally, yellow-green; in other respects the male is like the female.

Type locality: Campus of Oregon State College, CORVALLIS, OREGON. Host: *Dasyneura* sp. infesting seeds of *Thuja plicata* Don. and *Chamaecyparis lawsoniana* Parl.

Location of the Types: The female type, the male allotype, 50 female and 50 male paratypes are in the California Academy of Sciences. 12 female and 12 male paratypes have been deposited in each of the following institutions: U. S. National Museum; Southern California Academy of Sciences, Los Angeles; American Museum of Natural History, New York; Museum of Comparative Zoology, Cambridge, Mass.; State Natural History Survey Division, Urbana, Ill.; British Museum (Nat. Hist.), London; Cornell University; State College of Washington, and the Oregon State College collection. The following private persons have received 6 female and 6 male paratypes: Dr. Osmond P. Breland and Dr. W. W. Jones. 43 female and 7 male paratypes are in the author's collection. There is a total of 193 female and 158 male paratypes.

Described from 165 females and 136 males collected by sweeping *T. plicata* and *C. lawsoniana*, August 23 and 24 and September 27, 1947; 5 females and 10 males by sweeping, Corvallis, Oregon, June 2 and 11, 1948; 2 females and 4 males reared in laboratory during April, 1948, and emerged in laboratory May 7, 1948; 1 female from Estacada, Oregon, collected in cones March 26, 1948, and emerged in laboratory on May 11, 1948; 2 females and 1 male collected in cones at Port Orford, Oregon, on May 30, 1948, and emerged in laboratory on June 3, 1948; 19 females and 8 males collected in Ashland, Oregon, in cones on May 18, 1948, and emerged in laboratory from May 23 until June 15, 1948. Specimens not included in the type series were also found in cones from 10 miles west of Philomath, Oregon and 12 miles east of Cave Junction, Oregon. In the material inspected, specimens were not found in cones from the following localities: Campus of Chico State College, Chico, California; and Hillsboro, Oregon.

Variation—The general color of the male and especially the female varies from green with a few slight yellow reflections to rather dark purple. In one particular specimen, also included in the type series, the lateral and ventral body regions and coxa were a brilliant ruby red. In other respects, there can be no doubt that this specimen belongs to *T. festivus*. The femur and tibia of both sexes varied from honey yellow to brown to bright blue-green. In the female, the length of the body varies from 1.65 mm. to 2.90 mm. and the ovipositor from 1.40 mm. to 2.40 mm. In only one instance was the ovipositor found to be the same length as the body. The average body length is 2.14 mm.; the average ovipositor length, 1.85 mm. The body of the male varies in length from 1.30 mm. to 2.30 mm., the average being 1.90 mm.

Torymus festivus is most closely related to *Torymus coloradensis* Huber whose host is *Cecidomyia* species gall on *Artemisia*. *T. coloradensis* Huber, however, differs in the following respects: body generally green, all segments of the funicle longer than wide, mesepimeron very deeply incised, coppery, and wings strongly ciliated. It is interesting to note that the hosts of both parasites belong to the same family of Diptera.

BIOLOGY

While studying the development of the torymid life cycle, I had the unusual opportunity of watching the continuous change from the last larval instar to the pupal stage. Three days before pupation, the development of the hind intestine and anus is evidenced by the clearing of the ventriculus of all waste products. At first the body becomes slightly constricted marking off the thorax from the abdomen. Shortly the appendages begin to form ventrally and the abdomen lengthens. The legs appear first and are followed by the antennae and wings. By the time the wings and head take their shape, a large mass of tissue forms on the posterior end of the body, dorsally. The abdomen swells and by writing movements the skin is split over the head and worked off in about 10 minutes. From the mass of tissue just mentioned, the ovipositor commences to grow up over the abdomen to a position overlapping the scutellum. The growth of the ovipositor is assisted by great arching movements on the part of the body. The complete growth of this organ takes slightly more than 30 minutes. Complete pupation takes less than 18 hours under laboratory conditions.

Since neither description nor illustration of the egg or larva of this genus could be found in the literature, a description of the egg and last larval instar is included herein. Females of several species of *Torymus* were dissected and the eggs were found to be constant in general shape and in surface texture. The egg of *T. festivus* is 0.58 mm. in length and 0.17 mm. wide. It is largest toward the anterior end and tapers gradually to a point posteriorly. The anterior end becomes restricted rapidly and ends in a prominent projection. The surface is smooth, without evidence of minute nodules or projections as found on the eggs of many members of the same family.

Fig. 1

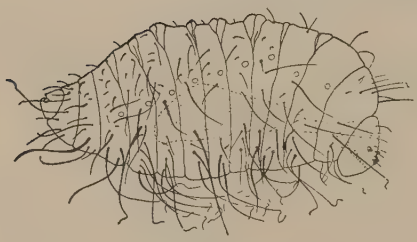


Fig. 2

Fig. 3

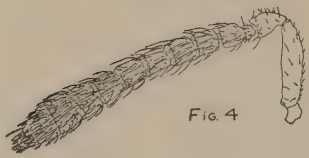


Fig. 4

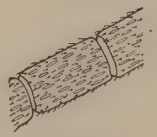
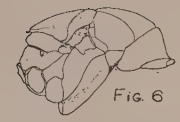


Fig. 5

EXPLANATION OF FIGURES

Fig. 1, lateral view of egg of *Torymus festivus;* Fig. 2, lateral view of mature larva of *T. festivus;* Fig. 3, front view of head of larva showing setal patterns; Fig. 4, antenna of female; Fig. 5, semidiagramatic drawing of portion of antenna of *T. gigantum* to show contrast with Fig. 4; Fig. 6, lateral view of thorax of adult female; Fig. 7, lateral view of abdomen of adult female; Fig. 8, front view of the head of adult female; Figs. 9, 10, 11 are photomicrographs of ovipositor saw, antenna and wing of *T. festivus female.*



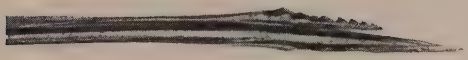


Fig. 9. Ovipositor saw

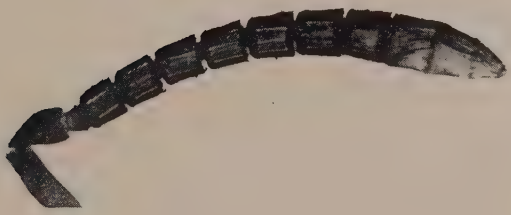


Fig. 10. Antenna

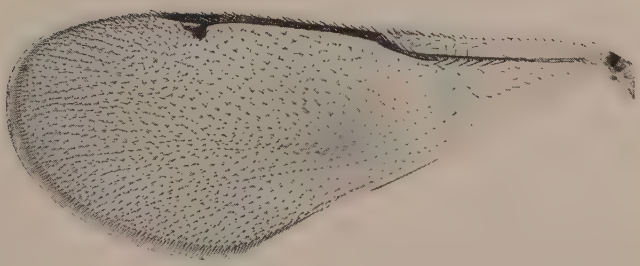


Fig. 11. Wing.

The last instar larva is cylindrical in cross-section, 1.6 mm. to 2.2 mm. in length and 0.83 mm. to 0.91 mm. in width. The head capsule measures between 0.31 mm. to 0.40 mm. across. The head viewed from the front bears three tubercles, one of which is quite prominent just above the fine uni-dentiate mandibles and two fine tubercles slightly below an imaginary line drawn halfway between the vertex and the ventral edge of the head and halfway toward the center from the lateral edges. There are five pairs of long setae on the face: three pairs along the lateral edge, one pair near the dorsal margin, and one pair about halfway between the latter and the paired tubercles. The remainder of the facial setae are minute paired sensoria hardly distinguishable under compound magnification. Abdominal segments 2 to 10 bear prominent, circular spiracles. The dorsal surface of all segments except the first bears very short setae. The dorsal surface of the first segment has several long, thick setae. The setae become progressively heavier and longer toward the venter of all segments. Each seta extending from the ventral surface has a fine barb at the end.

CLASSIFICATION

During research on the new species, *Torymus festivus*[3], several new characters and biological developments were recorded which may prove to be of importance in the determination of Chalcidoidea and of Torymidae in particular.

The following are three new taxonomic characters derived from the study made on this species of *Torymus*. The first characters noted are the setal pattern and a vein remnant of the wing. Many slides showing wings of different species of *Torymus* were prepared. These wings were photomicrographed and enlarged for quick comparison and specific determinations. Setal patterns, particularly in the areas of the stigmal vein and the wing base, varied sufficiently between species for separation. Within the stigmal knob itself are varying numbers and sizes of circular sensoria. These organs vary slightly within a species and also between wings of the same specimen. However, in a series containing at least 4 individuals of the same species there is a general arrangement of the stigmal sensoria found to be constant. A small crescent-shaped vein remnant one-fourth of the distance from base of the wing was found in *Torymus festivus*. This vein remnant varies among different species in the intensity of pigmentation from obscurity to relative prominence.

[3]I wish to express my appreciation to Mr. A. B. Gahan for determining *Torymus festivus* as a new species.

Illustrations and discussions have been published to express the value of antennal sense organs in generic and specific determination for certain other members of this super-family. To my knowledge, no previous mention has been made in the use of this character in the determination of Torymidae. In the process of clearing antennal material for slides, cellosolve was employed. This agent caused the sense organs to become well-defined. The organs appear to be of three types: sensilla trichodea; sensilla chaetica; sensilla placodea (Snodgrass, 1935). The sensilla placodea are the largest and most readily seen without special preparation from the pinned specimen. This particular organ does not vary perceptibly within the same species and shows great differences in size, number, and distribution between species. Observations indicate that the smaller the species, the larger and fewer in number the sense organs may be. This fact, in addition to others, indicates that there is a possibility of dividing the many species now included in the genus *Torymus* into two genera. Figs. 4 and 5 show marked differences between the sense organs of *T. festivus* and T. *giganticum*.

In various species of *Torymus*, the face, as seen from the front, differs in shape, robustness, setal arrangements and length, punctations and reticulations, color patterns and facial carinae. All of these are structural differences of significant use to the taxonomist. It is felt, however, that too little importance has been attached to facial carinae, two of which have never been mentioned in previous literature on this group of insects. I refer to those extending upward from the margin of the mouth, outlining the approximate position of the labrum found in orthopteroid insects.

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THE TAXONOMIC CHARACTERS OF THE LARVAE OF THE GENUS CULISETA FELT, 1904 IN CALIFORNIA[1]

(Diptera, Culicidae)

BY ERNESTINE B. THURMAN AND PHYLLIS T. JOHNSON

In order to facilitate the tremendous amount of identification required for operational field projects, a study was undertaken to discover characters in the fourth stage larvae of the four Californian species of *Culiseta* which could be used for identifying unmounted material with the aid of a dissecting microscope (x 72). The use of the taxonomic characters employed by previous workers are only in part suitable for this purpose.

The four species involved in this study are: *Culiseta* (*Culiseta*) *impatiens* (Walker, 1848), considered to be rare in the State, adults having been reported from Butte, El Dorado, Mariposa, Sacramento, and Shasta Counties; *C.* (*C.*) *inornata* (Williston, 1893), reported from 44 of the 58 counties in California; *C.* (*C.*) *incidens* (Thomson, 1868), the most widely distributed in the State, having been reported from 53 counties; and *C.* (*C.*) *maccrackenae* Dyar & Knab, 1906, with a distribution of 28 counties.

To separate *impatiens* from the other three species of *Culiseta* found in California, the character of similar upper and lower head hairs (see Plate 1, Fig. A) as listed by earlier authors (Freeborn, 1926; Dyar, 1928; Reeves, 1941; Freeborn and Brookman, 1943; Matheson, 1944; and Usinger, La Rivers, Chandler, and Wirth, 1948) appears to be adequate.

In the separation of *inornata* from *incidens*, previous workers have used characters to be found on the basal pecten teeth; in *incidens* these teeth have 1—3 minute or depressed denticles, while in *inornata*, 3—4 outstanding denticles are present. This character has proved to be reliable (see Plates 2 and 3), but somewhat impractical for rapid identification in that it necessitates the time-consuming task of mounting individual specimens. Differences in the size of the comb scales are figured (Plates 2 and 3) but also considered impractical as key characters.

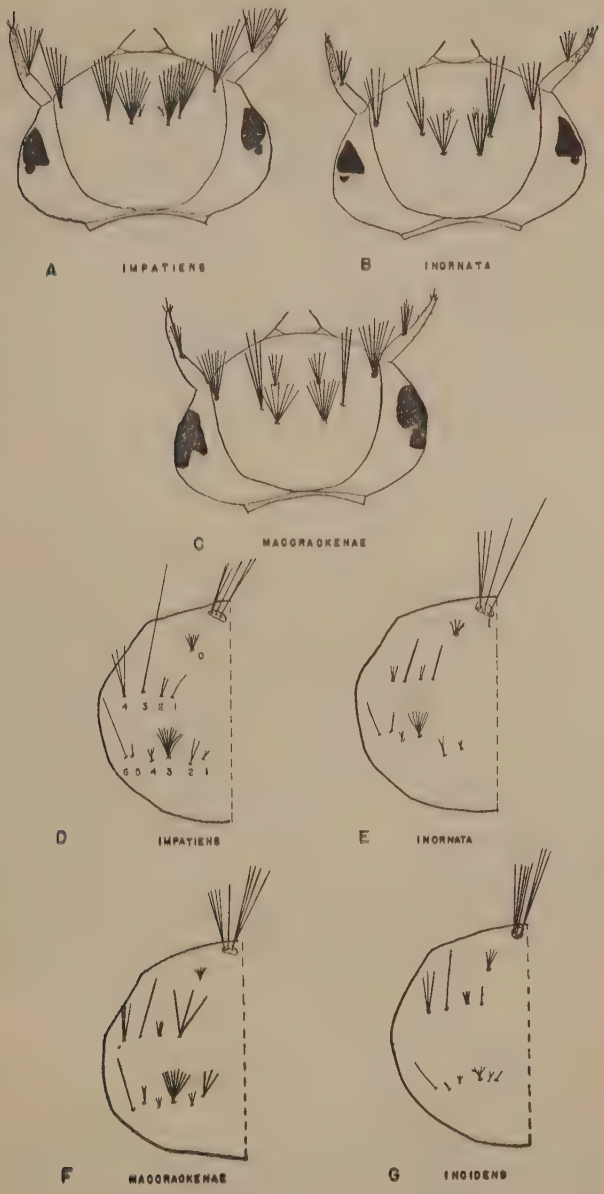
[1]From the Bureau of Vector Control, California State Department of Public Health, and the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.

C. maccrackenae was distinguished from *incidens*, *impatiens*, and *inornata* by the authors cited above, by characters of the anal segment. In *maccrackenae* the anal plate was said to have a cleft within which the anterior tufts of the ventral brush were inserted. In the other species, the cleft has been listed as lacking, the tufts puncturing the sclerotization of the anal plate. In a study of 480 larvae of the four species, including reared correlated series of all but *impatiens* (only one larval skin of a reared *impatiens* was available), variations were so evident in the size of the cleft and in the number and position of the tufts inserted within the cleft, that we have concluded that this character is much too variable for reliable diagnostic purposes. The percentages of variations found in this study are as follows: Of the *incidens* larvae, 33% had no cleft (considered by previous authors to be typical); 33% had one tuft within a small cleft; 18% with 2—3 tufts within the cleft; and 16% had all the tufts within a total cleft. Variations in *maccrackenae* also were pronounced, with 10% without a cleft; 20% with one tuft inserted within a small cleft; 50% with 2—3 tufts within the cleft; and 20% with all tufts within a total cleft (previously considered to be typical). Similar variations were found to exist in *inornata*.

To supplement these previously used characters for distinguishing the larvae of the four species, the following group of new characters are presented:

1. Variations in the branching and the length of the lateral hair of the anal segment.—These variations were found to be reliable in separating *inornata* from the other species (Plate 2). Boddy (1948) found this hair in *inornata* to be double and quite heavy, whereas in *incidens* it was occasionally triple, shorter, and was noticeably less robust. It is described by Carpenter, Middlekauff, and Chamberlain (1946, p. 111) for *inornata* as ". . . long, double or triple," but it may be 1—5 branched, is usually double, minutely barbed, and as long as or longer than the anal plate (Table I). In the other 3 Californian species the hair may be 1—5 branched, is usually triple, fine, not barbed, and ¼—¾ as long as the anal plate (Plates 2 and 3).

Plate 1.—Diagrammatic sketches of the head and thorax showing the dorsal hairs of diagnostic value of: Fig. A—*Culiseta impatiens;* Fig. B— *C. inornata;* Fig. C—*C. maccrackenae;* Fig. D—*C. impatiens;* Fig. E—*C. inornata;* Fig. F— *C. maccrackenae;* Fig. G—*C. incidens.*


A IMPATIENS
B INORNATA
C MACGRAOKENAE
D IMPATIENS
E INORNATA
F MACGRAOKENAE
G INCIDENS

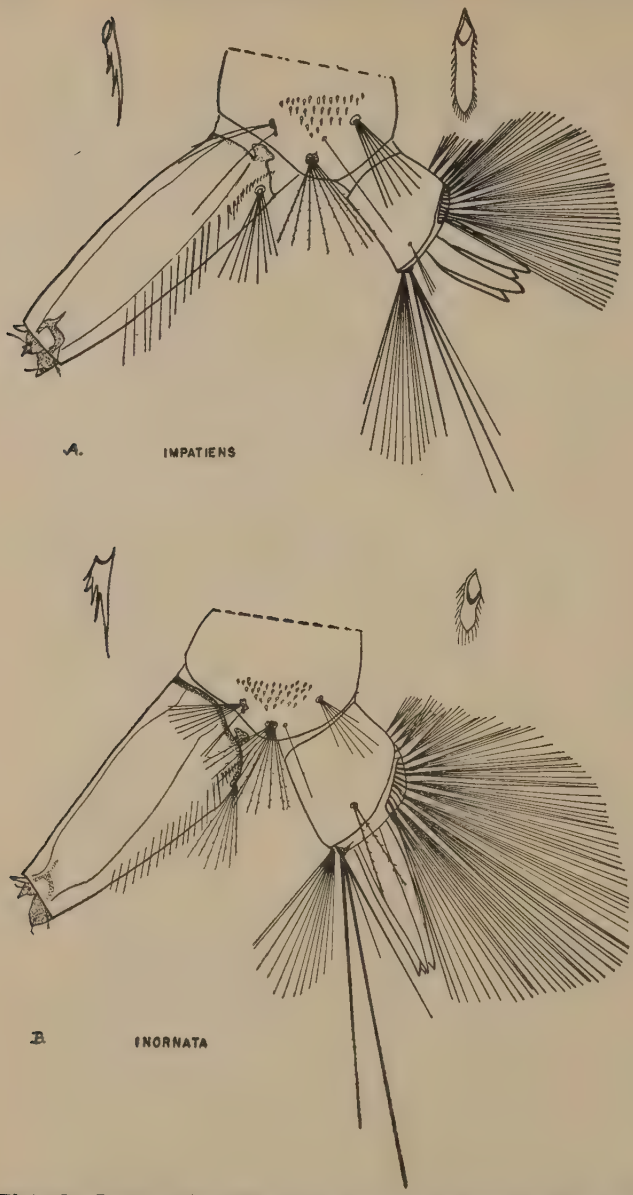


Plate 2.—Lateral view of eighth abdominal segment, siphon, and anal segment (comb scale and pecten tooth enlarged) of: Fig. A—*Culiseta impatiens;* Fig. B—*C. inornata.*

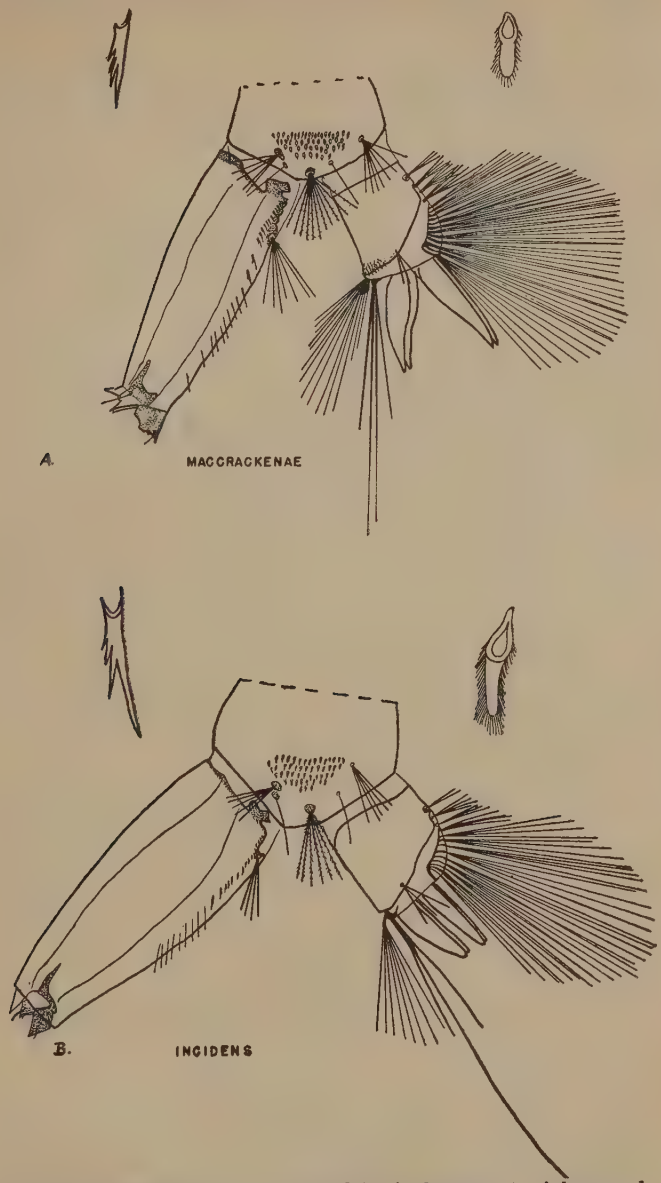


Plate 3.—Lateral view of eighth abdominal segment, siphon, and anal segment (comb scale and pecten tooth enlarged) of: Fig. A—*Culiseta maccrackenae;* Fig. B—*C. incidens.*
Plates 2 and 3 were drawn with the aid of a micro-projector.

2. An area of heavy short spines on the apex of the anal plate near the dorsal brush.—This spiny area is present in both third and fourth instars of *maccrackenae* while the anal plates of *incidens, impatiens,* and *inornata* are smooth.

3. The position of the basal siphonal tuft (as suggested by Dr. R. M. Bohart, through personal communication) and the texture, length, number, and position of the normal and hairlike pecten teeth.—The basal hair tuft in all four species is stellate, the branches being arranged much as the ribs in a partially opened umbrella, rather than spread fanlike in the same plane (Marshall, 1938, p. 207). In *maccrackenae,* the tuft is situated in a darkened area in the sclerotization, near the apical normal pecten teeth, which occurs at the apex of a scalloped cleft in the siphon. Following one or two widely-spaced, modified, normal teeth, the hairlike pecten teeth are short, less than ½ as long as the basal tuft, with one or two teeth apically detached; the row of teeth extends from the base along 4/5 the length of the siphon. In the other 3 species the tuft of the siphon is placed near the base of the pecten. The hairlike pecten teeth in *incidens* are fine, about ½ as long as the tuft, and extend beyond the middle of the siphon. In *impatiens,* the normal

Table 1. Percentages of Variations of the Lateral Hair on the Anal Plate of *Culiseta inornata* (Will.), *Culiseta incidens* (Thom.), and *Culiseta maccrackenae* D. & K.

Species	No. Tufts Studied	Distribution of Percentages of Branch Variations				
		Single	Double	Triple	Four-Branched	Five-Branched
C. inornata	112	6	59	29	3	3
C. incidens	522	4	27	42	21	6
C. maccrackenae	56	4	37	46	11	1

Table 1 (continued):

Species	Distribution of Percentages of Physical Characters					
	Texture			Length		
	Fine and Smooth	Slightly Barbed	Heavy and Barbed	¼-½ as long as Plate	⅜-¾ as long as Plate	As long as or longer than Plate
C. inornata	3	14	83	0	18	82
C. incidens	98	2	0	65	35	0
C. maccrackenae	98	2	0	46	54	0

pecten teeth extend from the base ¼ the length of the siphon. The hairlike pecten teeth are heavy, ⅔ as long as the basal tuft. The entire pecten extends ⅔ the length of the siphon. In *inornata,* these teeth are fine, ½ as long as the tuft, and the row reaches ¾ the length of the siphon.

4. The dorsal thoracic hairs.—These are illustrated in Plate 1, Figures D, E, F, and G, where the chaetotaxy followed is that employed by Marshall (1938, p. 47). Only those hairs used in differentiation have been figured. Prothoracic hair No. 1 (Plate 1, Figures E and G) in *inornata* (as pointed out by Dr. H. D. Pratt, personal communication) is single, and 1½ times as long as prothoracic hair No. 2; in *incidens,* this hair is either double or multiple, and slightly longer than hair No. 2; in *maccrackenae* and *impatiens,* this hair is similar in size and number of branches to that of *incidens,* with *maccrackenae* having from 2—8 branches and *impatiens* 1—3. The mesothoracic group of setae is diagnostic in *maccrackenae* and *impatiens* in that hairs Nos. 1 and 3 in *maccrackenae* are respectively, double to quadruple, and single; both prominent and heavy; in *impatiens,* No. 1 is single and inconspicuous, while No. 3 is single, and 6—8 times as long as the prothoracic hair No. 0 (Plate 1, Figures D and F). In both *inornata* and *incidens,* mesothoracic hair No. 1 is single and inconspicuous (Plate 1, Figures E and G).

5. The size of the postclypeal hairs (Plate 1, Figure C).—In *maccrackenae* these are prominent with 4—5 branches, and are almost as long as, and as heavy as, the upper head hairs. This is in contrast to the normal, small postclypeal hairs possessed by the other three species.

The following key to the *Culiseta* larvae of California has been prepared using the foregoing characters.

KEY TO FOURTH INSTAR LARVAE OF CALIFORNIAN SPECIES OF CULISETA

1. Mesothoracic hair No. 1 large, double to quadruple, and very conspicuous (Plate 1, F); postclypeal hairs 4—5 branched, prominent, about as heavy as those of the upper and lower head hairs (Plate 1, C); posterior margin of anal plate with heavy short spines at apex near dorsal brush (Plate 3, A) ..... *maccrackenae* Dyar & Knab, 1906

– Mesothoracic hair No. 1 small, less conspicuous, usually single; postclypeal hairs normal with branches noticeably more delicate than branches of the upper and lower head hairs; anal plate smooth 2

2. Both upper and lower head hairs multiple, fan-shaped, with branches equal or subequal in number and length (Plate 1, A); mesothoracic hair No. 3 single, conspicuous, 6—8 times the length of prothoracic hair No. 0 (Plate 1, D) ..... *impatiens* (Walker, 1848)

– Lower head hairs multiple, with two or three prominent middle branches; upper head hairs multiple, fan-shaped, with shorter and more branches than lower head hairs; mesothoracic hair No. 3, if single, inconspicuous, less than 6 times the length of prothoracic hair No. 0 3

3. Lateral hair on the anal segment as long as or longer than anal segment, rather stout and usually double (Plate 2, B); prothoracic hair No. 1 usually single (Plate 1, E) ..... *inornata* (Williston, 1893)

– Lateral hair on the anal segment shorter than the segment, rather fine, and usually triple (Plate 3, B); prothoracic hair No. 1 double or multiple (Plate 1, G) ..... *incidens* (Thomson, 1868)

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A SECONDARY HOMONYM IN THYSANOPTERA

(Thysanoptera: Phlaeothripidae)

Jones (1912)[1] described *Anthothrips flavipes* from a unique female collected at San Jose, California. Since that time the species has had a somewhat stormy taxonomic career, having been relegated in the literature to at least four additional genera. Hood (1949)[2] transferred this species to the genus *Watsoniella*, apparently overlooking the fact that Moulton (1928)[3] employed the name *Watsoniella flavipes* for a new species taken in Abyssinia.

It is unfortunate that Jones' name, which has appeared frequently in the literature, must be changed because of the coëxisting Moulton name preceding it in the genus *Watsoniella* by twenty-one years. I therefore propose the name *Watsoniella jonesiana nom. nov. pro Watsoniella flavipes* (Jones), *nec* Moulton.

—H. EDWIN COTT, *Davis, Calif.*

[1]U. S. Dept. Agr., Bur. Ent., Tech. Ser., No. 23, Pt. I, pp. 18-19, Pl. V, figs.5-7.
[2]Rev. de Ent., 20 (1-3):23-26.
[3]Ann. Mag. Nat. Hist., Ser. 10, 22:241-242.

OBSERVATIONS ON FLIGHTS OF PLEOCOMA CONJUNGENS

(Coleoptera: Scarabaeidae)

BY WILLIAM HAZELTINE

Richmond, California

The 1948 flights of *Pleocoma conjungens* Horn[1] in the area of Mount Hermon, Santa Cruz Co., California, began on the morning of October 27, between 7:50 and 8:00 A.M., and the last definite general flight was on December 13, at 8:30 A.M. (All times given are Pacific Daylight Saving Time. Standard Time is one hour earlier.) On two later occasions, December 31, 1948, and January 2, 1949, beetles with Pleocoma flight habits were seen in the Scotts Valley area. These could have been *P. conjungens*, but the sight record is not positive. The time and weather conditions were right for a flight, and a male from an earlier flight retained in an observation cage was still alive, indicating that this species probably was still capable of activities in the area.

The largest flights were from approximately half an hour before dawn to half an hour after dawn, and from sunset to approximately 45 minutes thereafter. They occurred only on rainy days or when the humidity was near the saturation point. Actual precipitation was not necessary to cause flight activity, as was evidenced by the behavior of a captive male. An observation cage was kept in a non-heated room, the air in which reflected outdoor conditions, and the beetle was active when there was heavy fog or rain outside.

The largest recorded 1948 flights occurred in the mornings, when about 85% of my males were taken. The remainder were captured during the evening flights. In all, 165 males of *P. conjungens* were collected at three stations in the Mount Hermon area.

During the first flight of the 1949 season (November 6), 107 males were taken almost continually from 10 P.M. to 6 A.M. There was a steady light rain all night, and a nearly full moon shone through the fog-like clouds enough to light the area somewhat.

The times of flight in the three collecting stations agreed very closely in beginning and ending. As the weather conditions were not the same at each place, the possibility of flight dependency upon some factor in addition to humidity was considered. Since the flights occurred during the crepuscular hours or when the moon was full, light may be a controlling factor. To test this hypothesis, the following experiment was tried: Males were allowed to become accustomed to earth in an indoor container. At 9 A.M., the soil was wet down and the curtains drawn. An hour later, males were ob-

[1]I am indebted to Dr. E. G. Linsley for identifying males.

served actively walking on the earth's surface, while the room was in semi-darkness. Within a few minutes after the lights were turned on, however, the beetles had all disappeared by digging into the soil.

Males in flight early in the season were strongly attracted to lights, but those in later flights did not show this phototropism, and had to be collected with a net.

Both males and females were watched as they dug. They used the flattened clypeus with a motion suggesting a scoop shovel, getting the head as low as possible and then lifting it and the dirt in front of or above the clypeus. The anterior tarsi were drawn up behind the strongly toothed and dilated fore tibiae, which were used to loosen dirt and move backward. The middle and hind legs pushed the body forward and also continued the backward movement of the loosened soil. The strokes of all the legs were lengthwise of the body. It was surprising that very few males had the fore tarsi missing, and that the heavier female could dig at a much faster rate that the male.

Males found in the ground were in unlined earthen cells within four inches of the surface. Captive males in the observation cage remained near the surface until the earth was wetted, whereupon they immediately started to dig to the surface.

Males enter the ground between flights, and this accounts for the numerous small holes that make it difficult for the collector to find the burrows of females. The burrow of a male is typically about half an inch in diameter and generally is free of loose dirt around the opening; that of the female is noticeably larger, about three quarters of an inch in diameter, and usually has loose dirt around the mouth. The burrow of the female also generally has a plug of loose earth an inch or two below the opening. This plug suggests that the female first comes to the surface, then turns around and goes down the open hole, pushing up dirt as she digs. A male and female were taken in the same burrow, the male above the female, and both were about 8 inches below the surface and headed down. This pair of beetles was in comparatively dry sandy soil.

The larvae of *P. conjungens*[2] were taken early in the spring in an area of grass and yellow pine roots. The three females found in the soil were in close proximity to the following plants:

1. *Pinus ponderosa* Dougl. Yellow pine.[3]
2. *Gnaphalium* sp. Cudweed.[3]
3. *Quercus agrifolia* Nee. Coast live oak.[3]

[2]Determined by Dr. E. G. Linsley.
[3]Determined by Dr. C. D. Duncan.

RECORD OF THE GENUS PROCATHAROSIA IN NORTH AMERICA

(Diptera: Tachinidae or Larvaevoridae)

BY PAUL H. ARNAUD

Natural History Museum, Stanford University, California

A male tachinid recently collected by the writer in Santa Clara Co., California, was kindly identified as *Petia calva* Coquillett by Prof. H. J. Reinhard of the Agricultural and Mechanical College of Texas. Dr. L. P. Mesnil of the Commonwealth Bureau of Biological Control, Zurich, Switzerland, also examined the specimen and found it to be congeneric with the genus *Procatharosia* Vill. Coquillett (1910) originally described the genus *Petia* with the new species *calva* as generic type, on the basis of two male specimens from San Pedro, California, and Moscow, Idaho. Villeneuve (1924) proposed the new generic name *Procatharosia* with *Catharosia flavicornis* Zetterstedt as type. Townsend (1915, 1936 and 1938) considered *Petia* Coquillett to be a synonym of *Catharosia* Rondani, 1868. This synonymy is incorrect because of the probable misidentification of the European species by Townsend. *Petia* was first used by Gray in 1839 for a genus of reptiles. Therefore, *Procatharosia* Villeneuve 1924 is the first available generic name and the American species should now be called *Procatharosia calva* (Coquillett).

The distribution of the two known species of *Procatharosia* is western Europe for *P. flavicornis* and western North America for *P. calva*. The specimens of *P. calva* studied are: ♂, Stanford University, California, July 1, 1949; 2 ♀♀, Stanford University, California, July 28, 1949; ♀, Redwood City, San Mateo Co., California, July 30, 1949; all collected by the writer.

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A WESTERN RACE OF LANGURIA MOZARDI

(Coleoptera: Languriidae)

BY PATRICIA VAURIE

American Museum of Natural History, New York

Examination of 114 specimens of *Languria mozardi* (Latreille), the Clover Stem-Borer, from various parts of Texas, Arizona, Utah, and northern Mexico, shows that in this area there is a race with the legs consistently darker than the *mozardi* of northeastern and southeastern United States. It is proposed to name it

Languria mozardi occidentalis Vaurie, new subspecies

Similar to *m. mozardi* in size and in coloration above, but differing from it in coloration below, *occidentalis* having more piceous on the femora and less piceous on the abdomen.

Type Locality: UVALDE, TEXAS, June 14, 1932, J. O. Martin, collector; type deposited in the California Academy of Sciences. 36 *paratopotypes*, 33 in the California Academy of Sciences, 3 in the American Museum of Natural History. 81 *paratypes* from: UTAH: St. George (Chas. Palm). ARIZONA: Phoenix, February 28, 1929 (J. H. O'Dell), August (D. K. Duncan), (Chas. Palm), June 24, July 4, 1942 (P. C. Grossman); Tempe, August 1 and 3, 1917, Corn. Univ. Exped. Lot 542; Globe, June (D. K. Duncan), February 23, 1936 (Parker), May 19 (Duncan and Parker); Tucson, Univ. Farm, June 4, 1926 (A. A. Nichol); Pima Co., September 1, 1925 (C. L. Marsh); Yuma, May 14, 1939 (Van Dyke Coll.); Maricopa Co., August 27, 1928 (O. L. B.); "Ariz." (Chas. Palm). TEXAS: Clifton, June 16, 1929 (J. O. Martin); Waco (Schff. Coll); Austin, April 7, 1924 (J. O. Martin), May 30, 1897 (G. W. Beck); New Braunfels, June 26, 1917 (Schff. Coll.); San Antonio, May (A. Fenyes Coll.), June, 1942 (E. S. Ross); Carrizo Spgs., June 12, 1932 (J. O. Martin); Ben Bolt, June 23, 1930 (J. O. Martin); Kingsville, Corn. Univ. Lot 912 Sub (C. T. Reed); Fedor, (Van Dyke Coll.); "Tex." (Schff. Coll.), (Chas. Palm). MEXICO: Chihuahua: Delicias, July 11, 1947, D. Rockefeller Exp. (Cazier); Sinaloa: Los Mochis, June 18, 1922 (Van Dyke Coll.). 29 paratypes in the California Academy of Sciences, 21 in the American Museum of Natural History, 13 at Cornell University and 18 in the collection of Frank H. Parker.

Discussion: In *occidentalis* the middle and hind femora are usually entirely piceous and always more than half piceous, in contrast to *mozardi* where they are usually less than half piceous or half piceous and half reddish yellow. This is a small but constant difference and is shown below.

Table 1. Color of the middle and hind femora of *Languria m. occidentalis* and *L. m. mozardi:*

	114 *L. m occidentalis*		196 *L. m. mozardi*	
More than half piceous	109	(96%)	21	(11%)
Half piceous	5	(4%)	110	(56%)
Less than half piceous	—		65	(33%)

The front femora in both races are at least half piceous, but they are usually entirely so in *occidentalis* and from half to three-quarters in *mozardi.*

On the abdomen, the three apical segments are entirely piceous in 280 of 299 *mozardi* specimens, or 93 per cent, and in another series, 152 of 170, or 89 per cent, have them piceous. In *occidentalis,* on the other hand, of 114 specimens, only 43, or 37 per cent, have these segments fully piceous; the same number (37 per cent) have but two apical segments piceous, leaving 29 individuals, or 26 per cent, more or less in between, with only part of the third apical segment piceous.

It seemed that, in general, the elytral punctuation was deeper and larger in *occidentalis* and the head and thorax more strongly punctate, but these characters were found to vary quite a bit in both populations and to be very difficult to assess objectively.

There are physiological and ecological differences between these races. Southwestern *mozardi* (*occidentalis*) has three distinct generations a year, the first passed almost exclusively on yellow sweet clover (*Melilotus officinalis*), the second and third usually on alfalfa (*Medicago sativa*), while in the east there is but one generation, usually passed on red clover (*Trifolium pratense*), but also on other host plants, mainly Compositae.

No specimens have been examined from New Mexico, Colorado, Nevada, California, or Lower California, but it is probable that individuals from these states would be *occidentalis* rather than *mozardi.*

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*New names in bold face, synonyms and homonyms in italics.

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